Technical Specifications for LT Single Phase 5-30 Amps Static Energy Meters.

1.0 SCOPE

This specification covers the design, manufacture, testing before dispatch, supply and random testing after delivery of ISI-marked LT AC single phase two wire 5-30 Amperes Static *energy meters* of accuracy class 1.0, with backlit LCD display.

The meter should be capable to record and display energy in KWh and demand in KW for single phase two wire A.C loads for power factor range of 0.5 Lag- Unity- 0.8 Lead, as per requirement given in this specification.

2.0 APPLICABLE STANDARDS

2.1 Unless otherwise specified elsewhere in this specification, the meter shall conform in all respects including performance & testing thereof to the following Indian/International Standards, to be read with up to-date and latest amendments/revisions thereof.

Sl No.	Standard No.	Title
1	IS 13779:1999 with latest amendments	Specification for AC Static Watt hour meters of Accuracy class 1.0 & 2.0
2	IEC62053-21	Electricity Metering equipments (AC)- particular Requirements Part-21 Static meters for Active energy (class 1 & 2)
3	IEC62056-21	Electricity Metering – Data exchange for meter reading, tariff and load control Part- 21: Direct local data exchange
4	CBIP, New Delhi Guide No 325: 2015.	Specification for AC Static Electrical Energy Meters and testing
5	IS 15959 : 2011 (With latest amendments)	Data Exchange for electricity meter reading, Tariff and load control-Indian companion specification

In case of any conflict or discrepancy, the order of precedence shall be
(i) IS.
(ii) IEC.
(iii) CBIP guide No. 325

In case of any difference between the provisions of these standards and the provisions of this specification, the provisions contained in this specification shall prevail.

2.2. **BIS STANDARD MARK**:

Meters shall have BIS standard “ISI” mark and supplier should possess valid BIS license.

3.0 CLIMATIC CONDITIONS

The meters shall be suitably designed and treated for normal life and satisfactory operation under the hot and hazardous tropical climate conditions. The meter shall be dust and vermin proof. All the parts and surfaces which are subjected to corrosion shall either be made of such material or shall be provided with such protective finish which provides suitable protection to them from any injurious effect of excessive humidity. The meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions:

i)	Temperature	4° C to 55°C (45°C in shade)
ii)	Relative Humidity	45% to 95% (Sometimes approaches to saturation)
iii)	Average annual rainfall	3000 mm
iv)	Max. wind pressure	150 Kg per Sq. meter
v)	Max. altitude	1000 meters.
vi)	Average No. of dust-storm days per annum	40 days
vii)	Average no. of rainy days per annum	90 days
viii)	No. of months of tropical Monsoon conditions per Annum	3 months
ix)	Isocerounic level	50 days

4.0 ELECTRICAL SPECIFICATION

4.1 PRINCIPAL PARAMETERS

Class Accuracy	1.0(No drift in accuracy during guarantee period)
Rated voltage(Vref)	240 V AC phase to neutral
Voltage variation	Meter should record correct energy for +20% of Vref to -40% of Vref
Frequency	50 Hz ±5%
No. of phases	Single phase two wire
System of Earthing	Solidly grounded (Wherever applicable)
Current Range (basic)	5 Amps. *(I_b)*
Maximum Current.	600% of I_b (30 A)
Starting current	The starting current of main measuring element shall be 0.2% of Ib
Power factor Range	0.5 lag - Unity – 0.8 lead
Power loss	a. **Voltage circuit**: The active and apparent power consumption in voltage circuit including the power supply of meter at reference voltage reference frequency and reference temperature shall not exceed 1.5 watt and 8 VA respectively (as per IS 13779:1999 with latest amendments). (b) **Current circuit**: The apparent power taken by the current circuit at basic current, reference frequency and reference temperature shall not exceed 1.0VA (as per IS 13779:1999 with latest amendments).
Short time over current	The short- time over current rating shall be 30Imax for one half cycle at rated frequency as per clause No. 9.2.3 of IS: 13779/ clause 7.2 of IEC 62053-21
Surge Withstand test	The meter shall withstand impulse voltage test at the rated impulse voltage of 10kV as per procedure laid down in IS: 13779:1999.
AC high voltage for class 2 insulation	4kV rms for one minute (as per IS 13779:1999 with latest amendments).
Insulation resistance test	The test shall be carried out as per procedure laid down in the IS 13779 Cl. 12.7.6.4 and the results shall conform to the IR value as mentioned in the above clause.

4.2. SUPPLY SYSTEM & POWER SUPPLY VARIATION

The extreme power supply variation for which an operating meter shall withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its normal operating conditions shall be as follows:

Specified operating range: 0.80 to 1.1 Vref

Limit range of operation: 0.60 to 1.2 Vref

The limits of error for voltage variation of + 20% to -40 % of Vref shall be as under:

Influence quantities		Value of current	Power factor	Limits of variation In % error
i	Voltage variation between - 40% to +20%	Ib *Ib*	1 0.5 lag	0.7 1.0
ii	10% of 3rd harmonic in current circuit	*0.6Ib* *0.6IMax*	UPF UPF	0.6 0.6

However, the bidder can offer meters which can withstand higher variations. Meter shall be functional and able to register energy even if the voltage falls up to 50% of the rated voltage and 10% of Ib at UPF.

4.3 RUNNING WITH NO LOAD

When 70% and 120% of rated voltage is applied with no current flowing in current circuit, the test output of the meter shall not produce more than one pulse / count. The minimum test period for this test shall be as per clause 8.3.2 of IEC 62053-21.

4.4 AUXILIARY POWER

The meter shall draw power for working of electronic circuit from phase and neutral.

4.5 TEMPERATURE RISE

a) Under normal conditions of use, external surface of the meter shall not reach a temperature, which might adversely affect the operation of the meters.

b) With each current circuit of meter carrying rated maximum current and with each voltage circuit carrying 1.25 times the reference voltage (applied for 2 hours), the temperature rise on external surface of the case shall not exceed the following value over and above an ambient temperature of 50° C (2 hours duration test).

Rise in temperature of external surface of the case	15° C.

4.6 LIMITS OF ERRORS

When meter is under reference conditions, the percentage errors shall not exceed the limits as specified in IS: 13779:1999 (with latest amendments thereof).

4.7 INFLUENCE QUANTITIES

The meter shall work satisfactorily with accuracy limits under the presence of the influencing quantities indicated under the table 17 of IS 13779.

5.0 GENERAL AND CONSTRUCTIONAL REQUIREMENTS

The Meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

Meter shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. The following should be ensured:

a) Personnel safety against electric shock.
b) Personnel safety against effects of excessive temperature.
c) Protection against spread of fire.
d) Protection against penetration of solid objects, dust and water (Meter shall conform to the degree of protection IP 51 of IS : 12063/ IEC 62052-11 clause 5.9) .
e) Provision of anti- tamper features.

5.1 METER CASE

a) Meter case (base and cover) and Extended Terminal Block Cover (ETBC) shall be made of Unbreakable Flame retardant High grade UV stabilized Poly Carbonate with minimum thickness of **2.0 +/- 0.2 mm** and of good dielectric and mechanical strength.

b) Meter case (base and cover) and extended terminal block cover (ETBC) should be injection moulded in UV stabilized poly-carbonate. The Meter base shall be opaque. The Meter Cover and ETBC shall be kept fully transparent. The moulded meter case should not change in colour, Shape, size, dimensions when subjected to 200 hrs on UV test as per ASTMD 53. It should withstand glow wire test as per IS 13779 and heat deflection test as per ISO 75. The utility reserves the right to conduct tests for material verification at any time.

c) The window portion shall be fully transparent, unbreakable UV stabilized polycarbonate for easy reading of all the displayed values/ parameters, nameplate details and calibrating LED. The window should be scratch and break resistant with silicon coating. It should not fade in course of time and become opaque causing inconvenience for reading.

d) The meter cover should be ultrasonically welded with the meter base. The cover shall not just be held with base on two points of sealing. It should be supported all along the boundary of base and cover of the meter as well, so that even before ultrasonic welding, the cover should be fit perfectly with the base. The ultrasonic welding of meter case shall be such that if in case of any attempt to open the meter cover from base, there should be a clearly visible evidence of opening / tampering of meter case, meter shall display “Meter Cover Open” permanently.

e) The meter case (Base and cover) shall have the following properties of plastic material. The utility reserves the right to test at appropriate laboratory preferably at CPRI. The vendors have to submit a separate sample meter if required.

Sl.No	Property	Units	Value	Standards
1	Physical water Absorption	%	Max. 0.35	ASTMD 570/ IS:5133(part 2) :1969
2	Electrical Dielectric Strength at 90° C. in oil.	kV/ mm	Min 16	ASTMD 149
3	Thermal HDT	° C	Min. 125	ASTMD 648-01 ISO 75
4	Flammability			UL94/ IS:11000(part 2-sec-1) IEC-60695-2-1-12 & IS:11000-2-1
	a) Rating		FV 2 Passes	
	b) Glow wire test 650°C			
5	Mechanical			
	a) Tensile strength	MPa	Min. 50	ISO 527 1 any equivalent std.
	b) Flexural strength	MPa	Min.90	ISO 1781 any equivalent std.
	c) Modulus of Elasticity	MPa	Min. 2000	ISO 1781 any equivalent std.
	d) Izod impact Strength notched	kJ/Sq.m	Min.8	ISO 180/ lA or any equivalent std.

	23° C.			

5.2 TERMINAL BLOCK, TERMINAL AND EXTENDED TERMINAL BLOCK COVER

a) The terminal block shall be moulded type made of non-hygroscopic, flame-retardant material having good dielectric and mechanical strength. The moulded terminal block shall be made from best quality phenol formaldehyde/high impact strength UV stabilized Glass filled Poly Carbonate conforming to IS: 13779:1999(latest amendment) having adequate insulating properties and mechanical strength with tin-plated brass inserts for connecting terminals.

The terminal block should satisfy all the conditions specified in IS: 13779 and IEC 62052-11. The material of the terminal block should fulfill the requirement of following tests:

i. The flame retardant rating of V 0 as per UL 94 testing.
ii. The glow wire test for temperature of 960°C as per IS: 11000 (Part-2/Sec.l) or IEC 60695-2-1.
iii. Heat deflection temperature (HDT) test of 135°C as per ISO 75 or ASTM D-648
iv. Ball pressure test at 125°C as per IEC 60335-1.

b) The base of the meter should extend to enclose the three sides (back and two sides) of the terminal block.

c) The current circuit conductors of the meter shall be connected to its current terminals from inside the meter terminal block adopting procedure prescribed in either B-1 or B-2 of the recommended methods under IS: 13779. Any other method which meets these requirements in a better manner/way shall also be considered. The bidder should elaborate the arrangement adopted.

d) The meter terminal block shall have tin-plated brass terminal inserts. The terminals shall have suitable construction with barriers and cover to provide firm and safe connections of incoming and outgoing leads. The terminal screws shall have flat bottom so as not to pierce in the external conductors. All electrically live screws shall be of nickel/ tin plated brass. The terminals shall be of suitable rating to carry continuously 150% I_{max} Current -and made of electroplated (or tinned) brass. Any other provision which meets this in a better manner / way shall also be considered. The bidder should elaborate the provision adopted.

e) The manner of fixing the external conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. All parts of each terminal shall be such that the risk of corrosion is minimized. Two screws shall be provided

in each incoming and outgoing terminal for effectively clamping the external leads or thimbles. Each screw shall engage at least 3 threads in the terminal. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. It should be possible to directly insert the solid or stranded wire into the terminals.

f) The internal diameter of the terminal holes should be minimum 5.5 mm and adequately designed for inserting up to 16mm^2 Aluminum stranded armoured cable sizes and shall be capable of carrying continuous current up to 150% of I_{max}. The holes in the insulating material of the terminal block, which form an extension of the terminal holes, shall be of sufficient size to accommodate the insulation of the conductors also. The clearance and creepage distances shall not be less than values specified in clause 6.6. of IS: 13779: 1999. Further, the supporting webs between the two terminals of the terminal block should be sufficiently high to ensure that the two neighboring terminals do not get bridged by dust or a flash over does not take place.

g) The voltage circuit and the current circuit shall be solidly connected inside the meter body without any link. A firm connection shall be established within the meter case to energize the voltage circuit.

h) The termination of current circuit wires, if used, inside the meter (i.e. CT primary conductor / shunt) on the terminal block should be through lugs and washers of proper size. The loop length of the primary current circuit should be kept minimum. Alternatively, the CT primary conductor / shunt may be flattened to form a 'lug' like shape for proper terminating on terminal block without using lug or any other better arrangement may also be provided.

i) The meter shall be supplied with a cover which covers the meter terminals and generally the ends of the external wires or cables connected to the terminals and can be sealed independently of the meter cover. When the meter is mounted on the meter board and thereafter energized, no access to the terminals shall be possible without breaking the seals of the terminal cover.

j) Terminal cover shall be hinged and shall not be detachable. The sealing arrangement of the meter should be such that meter terminals shall be rendered inaccessible after the terminal cover is sealed. Provision for the seal should be made on front side of the meter terminal cover. The ETBC shall be designed such that the meter's internal parts are not accessible for tampering without breaking the seal(s). Suitable barriers in moulding shall be provided such that direct access to incoming/outgoing terminals is not possible through gaps left in cable entry holes after insertion of main/load side cables. The terminal cover shall be engraved/screen printed/ embossed with logo of manufacturer.

5.3 CT's/SHUNT ARRANGEMENT

a. The current sensing in the meter shall be based on CT and / shunt type. This is necessary to ensure accurate recording by the meter during the condition when DC component exists in the load, Phase and neutral currents to be compared and higher of the two to be used for measurement. Specific confirmation to be submitted by the bidders that accuracy of measurement will not suffer due to utilization of shunt on account of thermal stability and temperature coefficient, up to an operational temperature of 80°C.

   The CTs shall have proper magnetic shields and shall be mounted with the meter base through proper fixing arrangement so that it should have a firm support and should not move from its position in any case.

b. The meter should not saturate upto 720% Ib and should record energy accurately.

5.4 DISPLAY PARAMETERS AND TYPE OF DISPLAY

a) The meter should have bright LCD electronic display with backlit having minimum description of parameters (e.g. words like KWh, kW, Billing parameters values etc)/character height X width of 8 mm X 5mm or higher and with minimum 6 digits (with one decimal digit) i.e. 5+1.The decimal digit shall be clearly distinguished from integral digits.

The LCD shall be of STN (Super Twisted Nematic)/superior type, construction suitable for temperature withstand of 80°C (storage) and 65° C (operation). The LCD Display should have a wide viewing angle of 45° to 60° cone, up to one meter distance.

The registered parameter shall not be affected or lost by power failure. The display shall not be affected by electrical & Mechanical disturbances. The Nonvolatile Memory (NVM) shall have a minimum retention time of 10 years under unpowered condition i.e. the NVM shall have a storage life (without use) of 10 years. The NVM shall be independent of battery back up.

All important data such as calibration data, billing parameters and cumulative kWh should be stored in NVM internal to the main processing circuit and it should not be possible to change the data through any standard serial communication. For clear visibility of the display of the meter reading at a distance, large viewing area with large display icons is preferred.

The accuracy of display parameters on LCD display for all parameters shall be matching with the accuracy class of meters as per IS.

The display of various parameters shall be scrolling one after

another. The meter shall be capable to measure & display continuously 'Active energy kWh' at all the loads & power factors i.e. 0.5lag - Unity – 0.8 lead. The meter should also have provision for Automatic recording of cumulative kWh at 24.00 Hrs on the last day of the month for each calendar month and the same should go to memory.

b) Display Parameters: The meter shall display the required parameters in two different modes as follows:

i. AUTO SCROLL DISPLAY

The display of following parameters herein after referred to as "Auto-Scroll parameters", shall be displayed in an auto-cyclic mode, in the following sequence:

a. Current date and time
b. Cumulative active energy (KWh)
c. Billing MD (First Previous Month MD in kW with date& Time (b1)).
d. Instantaneous Voltage (Volt)
e. Instantaneous Current (Amp).
f. Instantaneous Power (Watt)
g. Cumulative Tamper Counts (TAMP)
h. Cumulative apparent energy (KVAh)

The above parameters shall be rolled over every 5 seconds each.

(Details of the legends shall be as above and are required to be printed below name plate details in short, for convenience of the meter reader.) Stickers of any kind will not be acceptable.

ii. PUSH BUTTON DISPLAY

The following parameters shall be displayed, one after other, with press of push button each time. The display shall have suitable display time for each measured values, except the LCD segment check, which shall have display of 2 seconds. There shall be one push button to facilitate scrolling of parameters.

a. LCD Segment Check
b. Sl. No. of meter.
c. Date & Time (Date: DD-MM-YY, Time: Hrs-Min.)
d. Cumulative Active Energy (kWh).
e. Billing MD (First Previous Month MD in kW with date& Time (b1)).
f. Cumulative Active Energy (kWh) for each calendar month for previous six months history. Maximum demand (in kW) with

30 minutes integration period and maximum of these in a calendar month for previous six months history may be given in separate page.
The legends for kWh and MD may be as below:

Months	MD	Energy
August (Current Month)	MD	kWh
July	MD1	kWh1
June	MD 2	kWh2
May	MD3	kWh3
April	MD4	kWh4
March	MD5	kWh5
Feb	MD6	kWh6

g.Cumulative Active Energy in High Resolution mode with 3 decimals.
h. Instantaneous voltage (Volt).
i. Instantaneous phase current (AMP-P)
j. Instantaneous neutral current (AMP- N)
k. Instantaneous load in Watt (LOAD).
l. Last magnetic tamper occurrence with date and time.

Note:

1. Push button mode shall have facility to lock and unlock the display (by pressing the button for few seconds continuously). OR separate page for High resolution mode shall be provided.
2. DOT matrix type LCD shall not be accepted.
3. The LCD display of the meter should be backlit. The back lit should not glow during power off condition.
4. The RTC accuracy should be within ±3 minutes per year and crystal should be temperature compensated for temperature range of 0 to 50°C.
5. The display with push button shall be auto off type. After the completion of display cycle, it should revert back to normal auto scroll reading **cycle**. It shall not be necessary to keep button pressed and continue the display cycle. Fresh button press will be required after resumption of auto scroll cycle to display the above parameter again.
6. Meter shall display direct reading and without multiplying factor.

c) LCD least count : The internal least count of energy recording shall not be more than 0.01 kWh. Hence, every 0.01 kWh consumption will be internally stored. Also, there will be no loss of energy registration on account of frequent power outages due to high start up time of the meter.
To verify the above, the meter will be tested as per clause No 9.2.2. IS 13779

d) Self Diagnostic Features
(i) 'LCD Segment Check' shall be provided to check all display segments.

(ii) The meter shall display unsatisfactory functioning or non-functioning of Real Time clock battery.

e) Meter reading at Power outage:

The meter shall have industrial grade long life battery with sufficient capacity to enable the meter reader to take meter reading even under power off conditions.

The primary battery activated through pushbutton during the power failure should be capable of at least 50000 such operations.

The above battery activated through push button during power failure, shall be available throughout the design life (10 years) of the Meter. No power shall be consumed from this circuit when mains are available. The same push button shall be used for displaying the readings included in auto scroll mode only during power outage.

In any case RTC battery power shall not be used for display under Power off condition. The other requirements of RTC and battery shall be as per clause 5.4g.

f) Maximum Demand registration and MD resets: Meter shall continuously monitor and calculate the average maximum demand of each demand Interval time of 30 minutes and maximum of these in a calendar month shall be stored. The maximum demand shall automatically reset at 24:00 hours of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer. The cumulative kWh should also be recorded at 24:00 hours on the last date of each calendar month for previous six months.

g) Real Time Clock and Battery: The MD integration cycle shall be on the basis of Real time clock of the meter. The maximum drift in real time clock of the meter shall not exceed ±3 minutes per year and crystal should be temperature compensated for temperature range of 0 to 50°C when powered by internal battery or supply. A lithium battery of adequate storage energy shall be used for energy supply to real time clock during no voltage or power off condition. The minimum guaranteed life of battery should be ten years.

5.5 OUTPUT DEVICE

The meter shall have a test output device in the form of calibration LED of red colour and minimum intensity 10 mCD (milli-Candela) and 5mm diameter LED accessible from the front and shall be capable of

being monitored conveniently with suitable testing equipment while in operation at site. The location of calibration LED should be such that the calibration pulses can be sensed easily through the sensor.

The relation between test output and the indication on display shall comply with the marking on the name plate (impulse per kWh).

Since the sequence of the output pulses may not be homogeneous, the bidder shall state the minimum number of pulse counts to ensure measurement accuracy of at least 1/10th of the specified error limits as per class of the meter at various test points.

The resolution of the test output pulse(s) should be sufficient to conduct satisfactorily accuracy test at the lowest load in less than 5 minutes and starting current test in less than 10 minutes.

5.6 CALIBRATION

The meters should be software calibrated at the factory. All important data such as calibration data, billing parameters and cumulative kWh should be stored in internal NVM to the main processing circuit and it should not be possible to change the contents in it through standard serial communication ports. There shall not be any mechanical form of calibration technique, such as mechanical preset/trim port or potentiometer so that any adjustment in calibration is not possible after freezing the meter constant. The meter shall be tested, calibrated and scaled at manufacturer's works before dispatch. This is to ensure that meter cannot be tampered at site.

5.7 COMMUNICATION CAPABILITY

The meter shall be ICS (Indian Companion Specification) compliant as per IS 15959: 2011 with latest amendments. The meter shall have provision of a galvanically isolated optical port to download the data locally through CMRI. This port shall also be used for remote data reading through modem. An additional RS232 port, in the form of physical interface connector RJ-11 which shall be used for remote meter data acquisition remotely through PSTN / Optical fiber / GSM / GPRS / CDMA / PLCC / LPR communication medium Rs232 port provided shall be galvanically isolated internally and terminated on RJ 11 connector. It shall not be possible to re-programme or make any change in the meter through CMRI.

a) For speedy and efficient data downloading through CMRI on base computer, licensed copies of base computer software shall have to be supplied free of cost. The software provided shall be user friendly and menu driven on Windows based operating system. The meter reading software should also be provided for CMRI free of cost. One copy of each software namely Base computer software

and CMRI software on CD is to be provided. The compatibility of transferring data from meter to CMRI and CMRI to base computer system should be easily established. The data transfer should be highly reliable fraud protected and tamper proof.

i. No editing shall be possible on CMRI and base computer by any means. The software shall have capability to convert the entire data Into ASCII format.
ii. Free of cost training for the use of software shall also be provided by the supplier. The software should have programmable facility to restrict the access to the information recorded at different security levels.
iii. The software should have polling feature with optional selection of parameters to be downloaded for AMR application.
iv. The Bidder shall arrange demonstration of the local and remote data transfer process at their own cost when intimated by the owner.
v. Optical port of the meter shall be provided with a suitable covered sealing arrangements having no physical access from outside without breaking the seal Rs232 port should be provided under the terminal cover so that it cannot be accessed with out opening the terminal cover Rs232 shall have suitable sealing facility.
vi. The supplier shall maintain the dimension of optical port as specified in IEC62056-21 so that there is uniformity in the optical port dimensions in all the makes of meters in ESCOMs.
vii. The supplier shall share the meter proprietary communication protocol, so as to enable downloading of meter data directly from the meter using optical port.
viii. The supplier shall fully cooperate by way of sharing their software or technology or whatsoever when ESCOM intends to upgrade or experiment with new technologies or implement any pilot projects in ESCOM involving meters.

5.8 TAMPER AND FRAUD PROTECTION

The meter should have tamper and fraud protection features as per Is 15959 Amendment No 2. (Draft document attached as an Annexure A) In addition the following shall be complied with if not included in Is 15959.

a. Current Reversal In current coil: The meter should register energy consumption accurately in forward direction irrespective of direction of current in the current coil (i.e. on reversal (interchange) of input (line) and output (load) terminals or phase and neutral interchange) - the reverse indication is recorded in the internal register **and also in display.**

b. Use of Earthing:

(i) On using earth in place of neutral (i.e. when return path of the load is not terminated back at the meter and instead current is drawn partially or fully through a local earth) irrespective of the phase and neutral connected correctly to the meter or reversed (the neutral current is more than phase current) the meter should Register accurately - the earth indication in the form of LCD icon shall be switched on.

(ii) Any combination of conditions described above under (a) and (b) (i) meter should register accurately.

c. Neutral Missing: When the neutral from both incoming and outgoing side are disconnected and the load is taken through earth, the meter should record energy **starting with not less than 20% of Ib** as per rated voltage, rated frequency and unity power factor in proportion to the current drawn with accuracy of meter within ±3% . The meter shall be link less type.

d. DC Immunity:

The meter should not saturate on passing of direct current which can cause the meter either to stop recording or record inaccurately as per IS: 13779 (latest version).

Apart from the above, meter should record energy as per voltage measured between incoming phase and neutral terminals when DC signal is injected on the neutral terminal of the meter through Diode. The test in this condition will be carried out at Vref applied to incoming phase and input terminal of diode.

e. External Magnetic Field:

The meters shall comply with the requirements of CBIP Guide No. 325 on application of external magnetic fields (A.C. and D.C.) as per the value(s) specified in the CBIP guide.

Besides the above, the meter accuracy or accuracy display under normal conditions shall not be affected by placement of a permanent magnet, of 0.5 Tesla +/-5% anywhere on the surface of the meter without meter box and the meter shall continue to record normally or record at Imax.

f. The threshold values for different tamper features shall be as under:

i. The starting current of main measuring element as per IS 13779: 1999 shall be applicable for neutral element.

ii. The threshold value for recording of energy under tamper condition (b)(i) above shall in no case be more than **5% Ib.**

g. The accuracy of the meter should not be affected by injection of high frequency AC voltage/Chopped signal/DC Signal and harmonics on outgoing leads of the meter.

h. The accuracy of the meter should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35 kV voltage at 10mm spark gap. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

i) On any of the phase or neutral terminals.

ii) On any connecting wires of the meter.

iii) At any place in load circuit

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions. Also, meter shall be tested for Immunity to Conducted Disturbances in accordance to IEC 62052-11 and any other tests as per relevant standards can be carried out.

The bidder should upload the details as to how their meter is able to detect/protect the above tampers and fraud with sketches and phasor diagrams wherever necessary. Additional features, If any, in their meter may also be clearly indicated.

i. TAMPER EVENTS:

Meter should have features to detect and login occurrence and restoration of tamper events with capture parameters (with time and date) as specified in IS 15959: 2011 with latest amendments. Persistence times 5 minutes + tolerance of 25 seconds.

j. Meter Cover Open: Display to be locked. The meter shall detect/ log with date and time of meter cover opening as 'tamper', even in absence of supply. This tamper shall also be displayed on the meter LCD as 'Meter cover open'. Meters should be recording continuously which is downloadable.

Details of last **fifty** tamper events with time and date of occurrence and **fifty** restorations should be stored in memory of the meter excluding power failure.

5.9 SEALING ARRANGEMENT OF THE METER

i. The meters shall be factory calibrated and ultrasonically welded and sealed with numbered seals suitably before dispatch.

ii. The meter cover shall be permanently ultrasonically welded to the meter base. It shall not be possible to open the meter cover without permanently damaging the meter cover or base, easily visible from the front. In order to make the ultrasonically welded meter base with cover, fool proof from tampering, two numbers (one by manufacturer and other by utility) of push-fit and double anchor type transparent (see through), tamper evident, moulded polycarbonate seals of 18x14x7 size shall be provided on the meter case-cover boundary. ***Good quality seals should have six digits non repeated numbers with embossing on both sides - one side with the logo of the manufacturer and on the other side the logo of ESCOM***. Only patented polycarbonate seals (seals from the manufacturer who has official right to manufacture the seal) shall be used. Two sealing screws shall be provided for proper sealing of the meter cover so that access to the internal part shall not be possible without breaking the seal.

iii. Additionally, two sealing holes shall be provided on meter case

suitable for inserting sealing wire of min. 2mm dia. One no. of sealing screw should also be provided to seal the terminal cover by the purchaser.

iv. The above sealing inserting arrangement (made at the factory premises) shall be integral part of moulded case. The provision of sealing shall also be integral part of the meter and the seals (provided to the main case at the factory) shall not be supplied loose with the meter.

v. A tracking and recording software for all new seals shall be provided by the manufacturer of the meter so as to track total movement of seals starting from manufacturing, procurement, storage, record keeping, installation, series of inspections, removal and disposal.

5.10 FIXING ARRANGEMENT OF METER

Every meter shall have three fixing holes - one at the top and two at the bottom. The top hole shall be provided with a special clip at the back of the meter/ shall be key-hole so that holding screw is not accessible to the consumer after the fixing of the meters. The lower fixing holes shall be provided on terminal block under the sealed terminal cover/ on the base under the sealed the terminal cover and meter is fixed by two screws so that after sealing the terminal cover both fixing screws cannot be accessed. The fixing screws shall be supplied with each meter in a pouch.

5.11 MARKING OF METER

The meter terminal marking and mounting arrangement should be as per Indian installation practices. The marking on every meter shall be in accordance with IS: 13779/IEC 62052-11.

Every meter shall have name plate beneath the meter cover window portion such that the name plate cannot be accessed without opening the meter cover. The marking on the name plate shall be indelible, distinct and readable from outside the meter, housed inside a transparent meter box. The name plate details or Serial Number affixed in form of sticker shall not be accepted. The name plate marking should not fade or otherwise be adversely affected by ultra violet (UV) exposure with lapse of time. The basic markings on the meter name plate shall be as follows:

a) Manufacturer's name or trade mark and place of manufacture.
b) Designation of type.
c) Number of phases and wires for which the meter is suitable.
d) Serial number of the meter.
e) Month and year of manufacture.
f) Reference voltage, frequency. .

g) Basic current and rated maximum current in Amps.
h) Principal unit (s) of measurement.
i) Meter constant (imp/ kwh).
j) Class index of meter.
k) Purchaser's order Number & date.
l) Guarantee period - 5 years.
m) Bar Coding of serial number,
n) Sign of insulation.
o) 'Property of BESCOM'
p) ISI mark with license number.
q)Category of meter as per ICS

5.12 CONNECTION DIAGRAM AND TERMINAL MARKINGS

The connection diagram of the meter shall be permanently engraved on the inside portion of terminal cover. Connecting terminals of current and voltage shall be in the sequence of Phase (in)-Neutral (in)-Neutral (out)- Phase(out). Further to this, terminal marking i.e. M1, L1 etc. OR suitable markings should be clearly embossed on terminal block which is visible distinctly from outside.

5.13 COMPONENTS

All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed makes like given as under so as to ensure higher reliability, longer life and sustained accuracy.

Sl.No.	Component function/Feature	Requirement	Make/ origin to be specified
1	Measurement/ computing chips	The measurement or computing chips used in the Meter should be with the Surface mount type along with the ASIC.	
2	Memory chips	The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges.	
3	Display modules	1. The display modules should be well protected from the external UV radiations. b) The display visibility should be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2	

		meters (refer 5.4(a) and (d) for Viewing angle). c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display (PIN Type). d) It should be STN **/superior** type industrial grade with extended temperature range.	
4	Communication Modules	Communication modules should be compatible for the two ports (one for optical port for communication with meter reading instruments & the other for the hardwired RS 232 port (RJ 11 connector) to communicate with various modems for AMR)	
5	Optical port	Optical port should be used to transfer the meter data to meter reading instrument. The mechanical construction of the port should be such to facilitate the data transfer easily.	
6	Power supply	The power supply should be with the Capabilities as per the relevant standards. The power supply unit of the meter should not be affected in case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. Power supply should be unaffected by the magnet.	
7	Electronic components	The active & passive components should be of the surface mount type & are to be handled & soldered by the state of art assembly processes.	
8	Mechanical parts	a) The internal electrical components should be of electrolytic copper & should be protected from corrosion, rust etc. The other mechanical components should be protected from rust, corrosion etc. by suitable plating/painting methods.	
9	Battery	Maintenance free Lithium with guaranteed life of 10 years.	

10	RTC & Micro controller.	The accuracy of RTC shall be as per relevant IEC / IS standards.	
11	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm with moisture resistant coating.	

5.14 LED/LCD INDICATIONS

a) LEDs /LCD shall be provided *for* following indications:
1) LED for Test output pulse (Imp/kwh) - Red
2) Icon on LCD for load earthing
3) Icon on LCD *for* current reversal
4) Icon on LCD *for* neutral missing
5) Icon on LCD *for* magnetic tamper
6) Icon on LCD for phase available
7. Icon on LCD for Meter Cover Open

b) The location of calibration LED (preferably at the center) should be such that the calibration pulses can be sensed easily through the sensor.

6.0 SALIENT FEATURES

The meter shall have following additional salient features:

a) The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

b) Even if phase to phase voltage i.e. 415 volts is applied continuously between phase and neutral of the meter, the meter should not get damaged and continue to record correctly within class 1 accuracy after restoration of normal supply.

c) The meter should not saturate up to 720% Ib and should record energy accurately.

d) The meter should not have any form of mechanical adjustments such as trim pots potentiometer etc. for calibration. The meter shall be tested, calibrated and sealed at manufacturer's works before dispatch. Further, no modification of calibration shall be possible at site by any means whatsoever.

The meter shall be software calibrated. All important data such as calibration data, billing parameters and cumulative kWh should be stored in internal NVM to the main processing circuit and it should not be possible to change it through standard serial communication.

e) The short-time over current rating shall be 30 Imax for one half cycle at rated frequency as per clause No. 9.2.3 of IS: 13779/ Clause 7.2 of

IEC 62053-21.

f) The meter shall withstand impulse voltage test at the rated impulse voltage of 10 kV.

g) The meter shall have internal industrial grade battery with sufficient capacity to enable the meter reader to take meter reading even under power off conditions. The industrial grade battery shall be capable to display the auto cycle parameters under the power off condition.

The primary battery activated through pushbutton during the power failure should be capable of at least 50000 such operations.

h) Meters shall be fully functional within 5 secs after the rated voltage is applied to meter terminal as per clause 11.4.1 of IS 13779.

7.0 GENERAL

a) All electrically live screws shall be of nickel/tin plated brass.
b) The meter shall draw power for its working through phase and neutral.
c) The terminal inserts shall be of heavily tinned brass.
d) The meter shall conform to the degree of protection IP 51 of IS: 12063/IEC 62052-11 clause 5.9 for protection against ingress of dust, moisture and vermin.
e) There should not be any change in the meter reading even at 120% & 70% of supply voltage.
f) The meter should be free from jumps in the reading during sudden switching of heavy loads/ transient voltage spikes.
g) Meter shall display direct reading and without multiplying factor.
h) Principle of operation of the meter, outlining the methods and stages of computation of various parameters starting from input voltage and current signals including the sampling rate, if applicable shall be furnished by the bidder.
i) The bidder shall furnish details of memory used in the meter.

8.0 ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT

The meter shall meet EMI/EMC requirements as specified in the relevant standards described earlier in this specification and shall also be protected against radiated interference from either magnetic or radio frequency sources. The meter shall be designed in such a way that the conducted or radiated Electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter.

The disturbance(s)/ discharge(s) to be considered are:

(i) Fast transient burst test
(ii) Electromagnetic H.F. fields
(iii) Electrostatic discharges.
(iv) Radio frequency interference suppression.

9.0 MANUFACTURING ACTIVITIES

a) All the materials, electronics and power components, ICs used in the manufacture of the meter shall be of highest quality and reputed make like mentioned in this specification to ensure higher reliability, longer life and sustained accuracy and there shall be no drift in the accuracy of the meter throughout its guarantee period.

b) The manufacturer should use application specific integrated circuit ASIC or Micro controller for metering functions.

c) The electronic components shall be mounted on the printed circuit board using latest surface mounted technology (SMT) except power components by deploying automatic SMT pick and place machine and re-flow solder process.

Further, the Bidder should own or have exclusive access (through hire, lease or sub-contract) of the afore-mentioned facilities.

Adequate documents regarding exclusive hire or exclusive lease shall be made available. In case of sub-contract, it shall be ensured that the subcontractor is not carrying out sub-contracting for any other bidder in the above tender. The bidder shall indicate with the name and location of such facility along with an undertaking and certificate from the utility and any ambiguity on such a confirmation shall result in immediate disqualification of the bidder.

The above shall be verified during works inspection or material inspection also and if any ambiguity is found, it shall be considered as a breach of contract by the successful bidder.

Bidders should have in-house design, development and manufacturing facility

The PCB material should be of glass epoxy FR-4 grade conforming to relevant standards.

d) All insulating materials used in the construction of meters shall be non-hygroscopic, non-aging and of tested quality. All parts which are likely to develop correction shall be effectively protected against corrosion by providing suitable protective coating.

e) Quality should be ensured at the following stages:

(i) At PCB manufacturing stage, each board shall be subjected to bare board testing.

(ii) At insertion stage, all components should undergo testing for conforming to design parameters and orientation.

(iii) Complete assembled and soldered PCB should undergo functional testing using test equipments (testing zig).

(iv) Prior to final testing and calibration, all meters shall be subjected to accelerated ageing test to eliminate infant mortality.

f) The calibration of meters shall be done in-house.

g) The bidder should submit the list of all components used in the meter along with the offer.

h) A detailed list of bought-out items which are used in the manufacture of the meter should be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought - out items.

i) The details of testing facilities available for conducting the routine and acceptance tests and other special tests on the meter shall be furnished with the bid. The facility available if any for conducting type test(s) may also be furnished.

10.0 SAMPLES FOR TESTING

a. Two nos. of sample meters conforming to the specification duly sealed along with the routine Test Certificates shall be furnished with the bid.

Note:- The main cover of one of the sample meters to be submitted along with the bid should be ultrasonically welded. The main cover of the other sample meter need not be ultrasonically welded, as at the time of sample testing, it shall be opened to ascertain conformity of meter's internal parts as per specification.

b. Void

c. Void

d. Void

e. After start of supplies and within the contract period, the owner at any time will select sample meters out of the Lots supplied to

Stores for testing at CPRI for conducting type tests and other tests as mentioned in this specification at the cost of Utility. The Bidder's representative can also be present at the time of selection. If the meters fail in the tests, action will be initiated as per the terms and conditions of the bid documents.

11.0 TESTS

11.1 a) **Type test as per IS:13779**: The type test certificates for all tests as per IS 13779 - 1999 (with latest amendments) shall be uploaded along with the bid. Type test certificates from any one of the standard Laboratories such as CPRI/ERDA/NPL/ ERTL shall only be considered. The type test certificates shall not be older than 5 years as on the date of NIT. In absence of these type test reports, offer shall be rejected out rightly. Type tests should be conducted on meter having similar constructional and other features.

b) **Additional Test**: In addition to the test mentioned at (a) above bidder shall also have to upload the following test reports (Not older than 5 years **as on the date of NIT**).

i. **External AC/DC magnetic influence tests as per CBIP Guide No. 325: 2015.**
ii. **Immunity to Conducted Disturbances in accordance to IEC 62052 -11.**
iii. **Compliance of anti-tamper features as per Clause 5.8 of this specification.**

However, for the test mentioned from b)i to iii) test certificates from standard laboratories such as CPRI/ ERDA/ NPL/ ERTL/ NABL accredited lab shall be considered.

11.2 List of tests to be conducted:

The successful bidders shall manufacture at least **15%** quantity of annual requirement or quantity as decided by the owner in this category and offer inspection call.

a) List of Tests: Meter shall pass all the Acceptance test as laid down in IS: 13779/1999 (with latest amendments). In addition, following tests shall also be carried out by adopting methods specified in IS:

13779 with latest amendments.

1. Vibration Test
2. Shock Test
3. Spring Hammer test
4. Voltage variation test as per this specification.
5. Test of DC components in AC circuits - The limits of variation in percentage error shall be 3.0% for class 1 meter at Imax/√2 and UPF, as per annexure D of IS: 13779.
6. Diode injection test as per clause 5.8 (d) of this specification.
7. Accuracy test under following anti tamper conditions:
   - Phase neutral interchanged
   - Ph-neutral normally connected and load earthed
   - Phase neutral interchanged and load earthed
   - Supply and load side interchanged and load earthed
   - Supply and load side interchanged and reversed and load earthed
   - Normal connection with partial earth load
   - Neutral disconnected at both sides.
8. Permanent magnet test (as specified in Clause 5.8 of this specification).
9. External magnetic fields (A.C. and D.C.) as per CBIP Guide 325.
10. Glow wire test for polycarbonate material.
11. Withstand Impulse voltage test at 10 kV shall be carried out on one sample as per procedure laid down in IS: 13779/1999 in NABL lab.
12. The sequence of display parameters shall be verified at the time of inspection in line with specification of meter.
13. When the meter is placed in oven in energized condition with reference voltage at a constant temperature of 65° C for period of 120 minutes, the LCD should not deform physically and functionally. After keeping the meter in unenergized condition at a constant temperature of 80°C for period of 120 minutes and when restored at normal temperature, the LCD should work satisfactorily.
14. If phase to phase voltage i.e. 415 volts is supplied between phase and neutral of the meter for 15 minutes, the meter should not get damaged and continue to record correctly after restoration of normal supply.
15. The accuracy of the meter may also be checked and it should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35

kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

- On any of the phases or neutral terminals
- On any connecting wires of the meter
- Voltage discharge with 0-10 mm spark gap
- At any place in load circuit

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions.

(b) Sampling Plan for test for as per table 20 of IS13779 Acceptance Test**:**

Number of samples for test from each lot shall be selected as per Annexure H, clause No 12.2.2.1 of IS13779.

Sl No	**Particular of tests**	**Sampling plan for the lot of 1001 and above**	**Criteria for acceptance of lot**
1	No load test and minimum starting current test	32 nos.	As per clause H-3.1 of IS
2	All other acceptance tests including meter constant test as per IS & GTP except repeatability of error test, vibration test and shock test in sequence to be mutually agreed between Manufacturer and Inspecting officer.	8 nos out of above 32 samples passing tests at Sl. no. 1.	As per clause H-3.2 of IS Annex.H
3	Repeatability of error test, vibration test and shock test, in sequence.	3 Nos. out of above 8 samples passing tests at Sl . no. 2	Each sample should pass all three tests.

The sampling plan shall be as per IS: 13779 except that maximum lot size may be read as 10,000 Nos. If offered quantity is more than 10000 Nos., sub-lots of maximum 10000 Nos. shall be taken for acceptance tests. Samples shall be selected at random from each lot/sub lot of meters and acceptance test as per relevant standards and additional acceptance tests as per technical specification shall be carried out on these samples.

(c) Facilities for conducting lot Acceptance Test:

Bidders should have all the facilities at their works to carry out lot acceptance test mentioned as per IS 13779. The standard meters used for

conducting tests shall be calibrated periodically at Govt. approved NABL Accredited Test laboratories and test certificates shall be available at Works for verification by purchaser's representative. **Bidders should have clearly mentioned the fact that they have all facilities to carry out Acceptance Test as per IS 13779 and, any false information in this regard shall be treated as breach of contract by the supplier and purchase order placed, if any, shall be liable for cancellation.** Vibration test, shock test glow wire test and impulse test 10kV mentioned in C1. 11.2 (a) shall be conducted at any Govt. approved NABL Accredited test laboratories at the time of acceptance of LOT if the facilities are not available at Bidders premises.

11.3 ROUTINE TESTS

All the Routine tests as laid down in IS: 13779:1999 (with latest amendments) along with Anti-Tamper Feature tests as described in Clause.5.8 of this specification shall be conducted on each and every meter by the manufacturer. Test results may be asked to be produced at any time by the purchaser or its representative. One set of routine test reports shall accompany each despatch consignment for reference.

12.0 RANDOM SAMPLE TESTING AT MT LAB AFTER RECEIPT OF METERS.

The sample of meters shall be selected randomly from the lot of meters supplied in store in approximately 1000: 20 ratios. This ratio can be changed by the purchaser. If any one meter fails in the testing, the meter is to be replaced by the supplier at free of cost. The samples will be selected by the purchaser's authorized officer. All the meters shall be sealed in MT lab before being despatched to the store.

13.0 GUARANTEED TECHNICAL PARTICULARS

The bidder shall upload all the necessary information as desired in the schedule of "Guaranteed Technical Particulars" and data appended. If the bidder desires to furnish any other information (s) in addition to the details as asked for, the same may be furnished against the last item of this schedule.

14.0 PACKING AND FORWARDING

The meters shall be packed in cartons / crates suitable for vertical/horizontal transport as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbol. Proper arrangement for lifting, such as lifting hooks or handles etc., shall be provided. Any material found short or broken inside the packing cases shall be

supplied immediately by supplier without any extra cost.
The packing shall be done as per the manufacturer's standard practice. However, packing should be safe and water-proof and manufacturer should ensure the packing is such that, the material should not get damaged during transit by Rail/Road.

15.0 REPLACEMENT OF DEFECTIVE METERS

The meters declared defective by the consignees and/or by meter testing lab shall be replaced by the supplier up to the full satisfaction of the purchaser at the cost of supplier within 3 days of intimation by purchaser/stores officer.

16.0 MAINTENANCE & GUARANTEE:

The meter shall be guaranteed for a period of Five years from the date of receipt of material. The bidder shall replace the defective meters within a period of 3 days from the date of intimation from the concerned consumer or from ESCOM authorities. The guarantee for the replaced meters shall start from the date of such replacement which shall be marked on name plate. In case defective meters are not replaced in stipulated period the penalty as per clause of delay in delivery shall be applicable.

17.0 QUALITY ASSURANCE PLAN

(a) The design life of the meter shall be 10 years and to prove the design life, the firm shall have at least the following quality Assurance plan :

i. The factory shall be completely dust proof.

ii. The testing rooms shall be temperature and humidity controlled as per relevant standards.

iii. The testing and calibrating equipments should be Automatic and all test equipment shall have their valid calibration certificates.

iv. Power supplies used in testing equipment shall be distortion free with sinusoidal wave- forms and maintaining constant voltage current and frequency as per the relevant standards.

v. During the manufacturing of the meters the following checks shall be carried out.

1. Meter frame dimensions tolerance shall be minimum.
2. The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
3. The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.

b. The Bidders shall invariably furnish the following information along with his bid:

i. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative & copies of test certificates.

ii. Information and copies of test certificates as in (i) above in respect of bought out accessories.

iii. Principle of operation of the meter, outlining the methods and the stages of computation of various parameters starting from input voltage and current signals including the sampling rate, if applicable shall be furnish by the bidder.

iv. The bidder shall furnish details of memory used in the meter.

v. List of manufacturing facilities available.

vi. Level of automation achieved and list of areas where manual processing exists.

vii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such test & inspections.

viii. List of testing equipment available with the Bidder for final testing of equipment specified and test plant limitation, if any, vis-à-vis the type, special acceptance and routine tests specified in the relevant standards and this specification. The limitations shall be very clearly brought out in schedule of deviation provided with the tender.

c. Deleted

18.0 ACCURACY OF METERS

There will be no drift in the accuracy of the meters supplied against this purchase order for a guarantee period from the date of supply. In case any drift is noticed / found beyond permissible limits during this period, the supplier shall recalibrate such a meter for correct accuracy, and in the event, recalibration is not possible, replace such meter (s) by new meter(s) without any extra cost.

19.0 DOCUMENTATION

1. The bidder shall furnish following along with bid;
   (i) One set of drawing clearly indicating the general arrangements, fitting details, electrical connections etc.
   (ii) Technical leaflets (user manual) giving operating instructions.
   (iii) A list of all components used in the meter.
   (iv) All information and documents as desired in clause-17 (QAP)

above.

2. Soft copy of operating manual shall be supplied to each consignee/ Divisions.
3. Soft copy of routine test certificates shall be furnished to MT lab with each consignment/LOT.

Sd/-
General Manager Ele.,
Meter & Commercial,
BESCOM